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ABSTRACT

The relationship between lifestyle behaviors and the onset of neoplasm development has been researched extensively. This study took a multivariate approach in attempting to identify lifestyle variables which could predict group membership among subjects diagnosed as having cancer and those subjects who have not been diagnosed as having cancer. Eighty adults without cancer and 36 adults with cancer completed the Northeast Louisiana University Cancer Study Questionnaire by providing patient identification, next of kin data, patient data, patient biographical and historical data, medical data, home ecological data, hobbies and recreational data, nutritional data, and eating outside the home data. A total of 19 lifestyle behaviors were measured. Discriminant analysis with a stepwise entry of variables was used to treat the data and resulted in a statistically significant discriminant function with three variables in the prediction equation. Variables measuring Vitamin C dose, educational background, and agricultural occupation were found to contribute significantly to prediction of group membership, with Vitamin C dose and education level being inversely related to cancer incidence and agricultural occupation being positively related to cancer incidence. The findings suggest that lifestyle behaviors can be used to successfully differentiate between cancer and noncancer groups. (Author/NB)

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LIFESTYLE BEHAVIORS AS PREDICTORS OF MALIGNANT NEOPLASM DEVELOPMENT

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This investigation sought to test the hypothesis that lifestyle behaviors can be used to differentiate between cancer and noncancer populations of subjects. Three hundred and twelve subjects completed a questionnaire measuring 19 lifestyle behaviors. Discriminant analysis with a stepwise entry of variables was used to treat the data and resulted in a statistically significant discriminant function with three variables in the prediction equation ($\underline{C}_r$ = .54, Wilks' lambda = .71, x^2 = 29.6, p less than .0001). Variables measuring Vitamin C dose, educational background, and agricultural occupation were found to contribute significantly to prediction of group membership. Results of this investigation suggest that lifestyle behaviors can be used to successfully differentiate between cancer and noncancer groups.

Lifestyle Behaviors as Predictors of Malignant Neoplasm Development

The relationship between lifestyle behaviors and the onset of neoplasm development has been researched extensively. No studies in the literature review for this thesis restricted the cause of cancer to the operation of any single factor acting alone; cancer seems to be multivariate in determination. In keeping with that observation, this study took a multivariate approach in attempting to identify lifestyle variables which predict group membership among subjects diagnosed as having cancer and those subjects who have not been diagnosed as having cancer.

Elwood, Pearson, Skippen, and Jackson (1984) studied the incidence of cancer of the oral cavity, pharynx, and larynx. They demonstrated a statistically significant association between the incidence of cancer of these sites and alcohol consumption. There was no significant difference in cancer development between male and female subjects. The authors concluded that although alcohol consumption and cancer are related, there is no evidence to indicate that ethanol acted directly as a carcinogen.

The influence of ethanol on the metabolism of nitrosamines--known carcinogens--was researched by Swann (1984). Studies have shown that nitrosamines may be present in the body after high-nitrate meals and alcohol are consumed. He considered the notion that ethanol consumption may act as a catalyst in the production of nitrosamines. According to Swann, the carcinogenic effect of ethanol may be mediated by its interaction with nitrosamines which are derived from diet, from tobacco, and from endogenous synthesis. He also hypothesized that ethanol may decrease the body's immune responses, thus increasing carcinogen susceptibility. Swann suggested that if his hypothesis is accurate, nitrosamines would be a significant factor in the development of malignant neoplasms. However, there is little evidence to support his hypothesis.

Potter (1982) conducted an international study on the impact of ethanol consumption on bowel and lung cancer. His research demonstrated a high correlation between beer consumption and incidence of cancer of the bowel and lungs. Potter also found a high correlation between beer consumption and rectal cancer mortality rates. His study was a correlational study in which exact causation could not be determined.

Potter and McMichael (1984) speculated on the association between alcohol consumption and lung cancer. He stated that alcohol may be a solvent for other carcinogens or may be a tissue irritant that increases the probability of cancer development. Potter and McMichael found that the incidence of lung cancer was high for people who abuse alcohol. He noted, however, that with one exception, researchers confounded alcohol consumption with smoking.

The influence of ethanol on cancer etiology was researched by Zaman et al. (1985). He concluded that alcohol abuse is one cause of cirrhosis. Cirrhosis of the liver was found to be a major risk factor in the occurrence of cancer.

The effect of diet on cancer has been a major concern of researchers. Byers, Vena, Mettlin, Swanson, and Grahm (1984) found an inverse relationship between lung cancer and intake of dietary Vitamin A; they found that Vitamin A is helpful in the prevention of squamous cell cancers in the lungs. Further research on diet (Kvale, Bjelke, & Gart, 1983) supports the finding that Vitamin A plays an important role in reducing cancer risk. Kvale et al. reported that an increased risk of cancer is associated with low rates of milk consumption,

as opposed to higher rates of milk consumption. Milk contains large amounts of Vitamin A.

The fact that colon cancer risk increases as fat intake increases was reported by Nair (1984). Colin (1985) conducted a study on diet and colon cancer risk. He found that a diet high in fat tended to enhance the production of bile, which is thought to act with carcinogens to induce cancer.

There is evidence that a diet rich in yellow and green vegetables will reduce the risk of cancer development. Colidity et al. (1985) state that yellow and green vegetables may be helpful in preventing damage to squamous and basal-cell tissues, thus reducing cancer potential.

There is a large body of research investigating the incidence of cancer across socioeconomic levels. Ernster, Selvin, Sacks, Merrill, and Holly (1982) found an inverse relationship between income level and cancer of the gum and mouth, esophagus, larynx, and lung. As income level increased, the onset of cancer at these sites decreased.

Stemhagen, Slade, Altman, and Bill (1983) studied the influence of occupation and liver cancer risk. They determined that farm laborers have a high risk of developing liver cancer. Arsenical pesticides were

thought to contribute to the onset of cancer in their subjects.

Coggon, Pannett, and Acherson (1984) investigated the relation between job exposure to chemicals and cancer of the bronchus. They found a direct relationship between working with either concrete or formaldehyde and cancer incidence. It was determined that exposure to these substances greatly increased cancer risk.

Dubrow and Wegman (1983) found that truck drivers had a high incidence of cancer. This high incidence was postulated to be a result of both exposure to diesel fuel fumes and to heavy cigarette smoking.

In a study conducted by Heldaas, Langard, and Anderson (1984), the incidence of cancer among vinyl chloride workers was shown to increase over time as exposure increased. They found that cancer of the skin, colon, lung, and thyroid gland increased with increased exposure to vinyl chloride. Nicholson´s (1984) findings are consistent with those of Heldaas et al. (1984).

It has been determined by Miller (1980), Weiss (1981), and Schottenfeld (1984) that there is a high risk of cancer development among coke oven workers. All three authors reported that coke ovens produce polycyclic aromatic hydrocarbons, which are thought to trigger the onset of cancer.

Professional and office workers were found by Beral, Shaw, Evans, and Miltown (1982) to have a high risk for some cancers. They suggested that flourescent lighting should be considered as the culprit, particularly in the initiation of malignant melanomas. However, they cautioned that flourescent lighting may not be the only factor involved. The findings of Beral et al. (1982) were questioned by Carlton-Foss (1982) who stated that there were possible confounding variables, such as toxic chemicals, smoking, and psychological factors. Carlton-Foss also questioned Beral´s et al. statistical procedure. Beral and Evans (1982) replied that there was no strong evidence linking melanomas with either smoking or with psychological factors. They also stated that, although a stronger statistical analysis should have been used, their findings should nevertheless be awarded cautious consideration until further data are collected.

Epstein and Swartz (1981) stated that cancer is the product of multiple causes and that smoking, along with the occupational environment, accounts for many of the reported cases of malignant neoplasm development in the workplace. The authors contended that the role of lifestyle factors, such as diet, has been exaggerated in the etiology of this disease and that more research

should be conducted on occupational exposure to carcinogens.

Vena (1982) researched the incidence of lung cancer in relation to airborn pollutants in urban locations. This study found that residents of urban areas tended to have a greater risk of lung cancer than do rural residents. The results were attributed to exposure of the urban residents to carcinogens at work, to more air pollution, and to more cigarette smoking. Vena commented that in assessing air quality, controlling for confounding variables is a difficult task. He stated also that his findings are consistent with those of many other investigations showing that smoking and long-term exposure to carcinogens at work are correlated with an increased cancer incidence. It was concluded that airborn substances may contain carcinogens which are transported into the lungs, thus causing cancer. Further research was suggested on the impact of airborn carcinogens on lung cancer risk.

Lung cancer has been associated with environmental carcinogens released from industries. Brown, Pottern, and Blot (1984) studied the effect of environmental exposures to pollutants emitted from a zinc smelter and from a steel manufacturing plant. They found an increased risk of lung cancer in residents who lived near

the two plants. It was suspected that air pollution contributed to the increased risk. The exact impact of air pollution could not be determined because of confounding variables. It was reported that soil samples contained large quantities of arsenic and cadmium, which suggests that these chemicals were transported by air. While these authors stated that a causal relationship between environmental pollution and lung cancer was not demonstrated, but they nevertheless suggested that there may well be a casual relationship between the two. It was proposed that further research is needed on industrially-polluted areas.

It has been determined that education and income level are associated with lung cancer. One study by Devesa and Diamond (1983) demonstrated that for both black and white males there is an inverse relationship between cancer incidence and education, and between cancer incidence and income. In general, blacks were reported to have a consistently higher incidence of lung cancer than were whites. This study found no association between either education or income level and malignant neoplasm development in white females. No significant relationship between income of black females and cancer was found, but there was a negative association between education and this disease for black females.

Research conducted by Beral and Robinson (1981) suggested that outdoor workers were more likely to develop squamous and basal-cell cancers than were indoor workers. It was stated that the incidence of melanomas on exposed parts of the body, such as head, face, and neck was higher among outdoor workers than among indoor workers. This study found that indoor workers were at higher risk than were outdoor workers for developing melanomas in regions of the body that were unexposed to sunlight.

Swanson, Belle, and Satatiano (1985), in looking for relationships between marriage and cancer, found that the incidence of cancer varies by anatomical site, race, and gender among married and nonmarried people. These researchers stated that it would be incorrect to believe that marriage would help prevent tumor development.

Lyon, Gardner, and West (1980a) researched the issue of cancer risk in relation to religion and place of residence. They found that in Utah, Mormons had a lower incidence of cancer than did non-Mormons. A breakdown of residence into urban and rural Mormons revealed an overall lower rate of cancer among urban Mormons. The urban dwelling non-Mormons, by contrast, had a higher cancer incidence than did rural dwelling non-Mormons, and the anatomical sites involved were those frequently

affected by alcohol use and smoking. The difference between Mormon and non-Mormon cancer incidence was speculated to be the result of differences in lifestyle behaviors.

Another study on religion and cancer incidence was conducted by Lyon, Gardner, and West (1980b). This study reviewed the incidence of cancer in Mormons and in non-Mormons of Utah. It was reported that Mormons have a lower risk of developing cancer than do non-Mormons. This low risk is thought to be the result of religious beliefs which denounce the use of tobacco, ethanol, tea, coffee, and any other drug-containing agent that is not used for medicinal purposes. The authors stated that Mormons show a low risk of developing cancer of the lungs, breasts, and digestive tract. The authors concluded that lifestyle behaviors play a major role in the occurrence of malignant neoplasms and that more research is needed to assess the impact of these behaviors on cancer.

The impact of religion on the etiology of neoplasm development was investigated by Phillips and Snowdon (1985). Their study demonstrated that Seventh Day Adventists were at a lower risk for developing some types of cancer than were non-Adventists. It was suggested that their religious customs--which condemn the use of

alcohol, smoking, and the eating of pork--contributed to the low risk. Although some dietary habits are advantageous in cancer reduction for Seventh Day Adventists, others, such as the high consumption of eggs, were positively correlated with colorectal cancer. However, it is believed that the Adventists' diet, which consists primarily of vegetables, contains protective factors which function as a prophylactic in preventing the transmission of carcinogens to tissues. These protective factors, such as Vitamins A and C, are known to be helpful in the prevention of malignant tumor growth (Phillips & Snowdon, 1985).

A study on population density as a factor affecting differences in cancer incidence between urban and rural residents was conducted by Nasca et al. (1980). Their results are consistent with previous findings that urban residents tend to show a higher risk of developing cancer than do rural residents. The authors reported a positive association between population density and cancer of the lungs, larynx, esophagus, pharynx, buccal cavity, and colon. For female subjects, there were significant relationships between population density and cancer of the ovaries and of the breasts. No one specific factor which contributed to differences between urban and rural locations in cancer incidence was detected. Differences

were postulated to be due to numerous variables, such as socioeconomic status, air pollution, and smoking habits.

Goldsmith's (1981) findings are consistent with those of Nasca et al. (1980), in that he found a higher incidence of cancer in urban areas than in rural areas. He speculated that the higher urban incidence might be an artifact of medical diagnosis, at least in part; urban residents receive diagnostic tests more frequently than do rural residents. Occupational environment, air pollution, and smoking habits were speculated to be the variables contributing to urban-rural differences.

There is a large body of research on the relationship between stressful life events and cancer development. Jacobs and Charles (1980) found that the incidence of cancer in children who experienced severe life changes was greater than the incidence observed in healthy children who experienced less severe life changes.

Cox and McKay (1982) investigated the psychosocial and psychophysiological mechanisms that might influence the onset of cancer. They concluded that adversive life events which alter the body's immune system could provide a psychophysiological basis for neoplasm development. In their study, they cited research from Higginson (1980) and Peacock (1976) who suggested that environmental

contamination from industries was not shown to play a significant role in the etiology of cancer. James Paget (1870), as represented by Cox and McKay, proposed that severe anxiety, deferred hope, and disappointment caused the growth of malignant neoplasms.

One study on the relationship between cancer-prone personalities and the development of the disease was conducted by Dattore, Shontz, and Lolafaye (1980). The Minnesota Multiphasic Personality Inventory (MMPI) was used to assess the personality characteristics of the cancer-prone patients. There was a significant difference between cancer and noncancer patients on the Denial Hysteria Scale of the MMPI. These authors proposed that the loss of significant objects increases cancer risk. To support their hypothesis of a cancer-prone personality type, they referred to research conducted by Bahnson and Bahnson (1964), who found that the use of repression and denial as defense mechanisms was associated with the onset of cancer.

Colby-Morley (1984) discussed emotional reactions, ego defenses, and traumatic life events that might contribute to the etiology of cancer. Traumatic life events are believed to weaken the body's immune system which, in turn, increases the risk of cancer. The

results of this study showed that subjects who had experienced severe stress were more likely to have cancer than moderately stressed subjects. The authors stated that cancer seems to be multivariate in determination and that direct causation could not be determined unless there was exposure to a known carcinogen, such as asbestos.

The investigation for this thesis was a study of the relationship between lifestyle behaviors and the occurrence of cancer in subjects residing in Northeast Louisiana. A questionnaire developed by Lawrence Baum, Director of the Northeast Louisiana University Cancer Research Center, was used to obtain extensive historical and lifestyle data on each subject. The questionnaire developed for cancer patients was modified slightly for use with noncancer subjects.

It was expected that lifestyle behaviors, as reflected by responses to selected questions on the Northeast Louisiana University Cancer Study Questionnaire (NLUCSQ), could be used to predict to which group--cancer or noncancer--subjects belong. This study is a first step in identifying lifestyle variables which predict the occurrence of cancer.

Method

Subjects

There were originally 312 subjects included in this study. The mean age of the cancer group was approximately 63 years, and the mean age for the noncancer group was approximately 40. Since there was reason to suspect a correlation between age and cancer incidence, it became necessary to control for age. Restriction of subjects to persons less than 56 years of age achieved a much more equitable distribution of ages between groups. The total sample then was reduced to 116. In the final analysis, there were 80 noncancer subjects and 36 cancer subjects. The mean age for the cancer population was approximately 39 years, and the mean age for the noncancer population was approximately 36 years. Both groups contained a mixture of individuals from different socioeconomic levels.

Measurement Scale

The NLUCSQ was developed by Lawrence S. Baum at Northeast Louisiana University. Baum devised this questionnaire in an attempt to find correlations between lifestyle behaviors and incidence of cancer in the 12 parishes of Northeast Louisiana.

The questionnaire is divided into 11 sections, which are as follows: 1) patient identification, 2) next of

kin information, 3) patient data, 4) patient biographical and historical data, 5) medical data, 6) tobacco use data, 7) occupational data, 8) home ecological data, 9) hobbies and recreational data, 10) nutritional data, and 11) eating outside the home data. This cancer study questionnaire was originally intended for use with cancer patients. As a result, some questions had to be altered to be made appropriate for a noncancer population.

Procedure

The data for cancer patients were obtained from a data base maintained by the NLU Cancer Research Center. This data base contains the lifestyle information and the medical records of cancer patients who reside or have resided in Northeast Louisiana. There were 212 questionnaires selected from those returned to the Cancer Research Center by the cancer patients. To obtain a representative sample for the noncancer group, 100 questionnaires were gathered from residents of Northeast Louisiana. These subjects were previously from civic and religious groups. A copy of the questions used for analysis from the cancer study questionnaire is listed in the Appendix. The numbers listed in the response area of the questionnaire are coded values that were used in the statistical analysis.

Results

The purpose of this investigation was to determine which of the 19 lifestyle behaviors selected from the NLUCSQ best discriminate between a cancer and a noncancer population. The data was analyzed by means of discriminant analysis with a stepwise entry of variables, the aim of which is to form the linear combination of discriminating variables which maximizes separation between groups, thus causing them to be as statistically distinct as possible (Klecka, 1980). The variable entering at the first step is the variable which best discriminates between groups. The second variable entering is the variable which, in combination with the first variable, best discriminates between groups. This process is continued until the inclusion of a variable no longer produces a statistically significant increase in separation between groups.

As was predicted, lifestyle behaviors successfully predicted group membership. Chi-squared (29.64), calculated on Wilks' lambda (.71), for the only discriminant function, was found to be statistically significant ($p < .0001$). A statistical summary is presented in Table 1. The discriminant function correctly classified 91% of the noncancer population and 53% of the cancer population. The overall accuracy of

Table 1

Discriminant Analysis Summary

Function	Eigenvalue	Canonical Correlation	Wilks' lambda	df	Chi-squared
1	.41	.54	.71	3	29.64*

*$p < .0001$

prediction was found to be 79%. A complete classification table is shown in Table 2.

Only 3 of the original 19 lifestyle behaviors were entered at the final step of the analysis. A list of these variables is presented in Table 3, along with the corresponding probability of F-to-remove values. These values indicate the relative contribution of variables to the discrimination between groups, beyond the contributions made by other variables (Klecka, 1980). Vitamin-C-dose made the greatest contribution to overall discrimination, followed by Education Level. The third and final contributor was Agricultural Occupation. Vitamin-C-dose and Education Level were inversely related to cancer incidence, and Agricultural Occupation was positively related to cancer incidence.

The univariate F ratios are presented in Table 4. Four of the 19 univariate F ratios reached statistical significance ($p < .05$). Vitamin-C-dose produced the most separation independently of the other variables followed by Education Level. The third variable was Pork Consumption Interval; the fourth was Job Stress.

A complete correlation matrix for lifestyle behaviors is presented in Table 5. This table shows the

Table 2

Subject Classification Results

Actual Group Membership	Number of Cases	Predicted Group Membership: Group 1	Predicted Group Membership: Group 2
Group 1: Noncancer	80	N = 73 (91%)	N = 7 (9%)
Group 2: Cancer	36	N = 17 (47%)	N = 19 (53%)
Overall accuracy of prediction: 79%			

Table 3

Variables in the Analysis After the Final Step

Variables	Probability of F-to-remove
Vitamin-C-Dose	0.0001
Education Level	0.0037
Agricultural Occupation	0.0129

Table 4

Univariate F Table

(*df* = 1, 87)

Variable	*F*	Significance
Job Stress	4.17	0.04*
Job Nervousness	0.33	0.57
Vitamin-C-Dose	16.60	0.01**
Meals Interval	3.74	0.06
Beef Interval	2.97	0.09
Pork Interval	5.11	0.03*
Organ Meat	0.13	0.72
Beer Interval	1.40	0.24
Mixed Drink Interval	2.11	0.15
Sex	0.70	0.41
Marital Status	0.92	0.34
Education Level	6.47	0.01*
Religion	0.25	0.62
Cigarette Smoking	3.60	0.06
Pesticide Exposure	0.99	0.32
Chemical Exposure	0.38	0.54
Agricultural Occupation	3.71	0.06
Oil Work	0.16	0.99
Chemical Work	1.33	0.25

* $p < .05$

** $p < .01$

Table 5

Correlation Matrix

	1									
1	1.00	2								
2	0.23	1.00	3							
3	-0.05	-0.07	1.00	4						
4	0.00	-0.01	0.23	1.00	5					
5	-0.10	-0.04	0.03	0.34	1.00	6				
6	0.13	0.07	-0.02	-0.00	0.02	1.00	7			
7	0.02	0.03	0.07	-0.06	-0.09	0.06	1.00	8		
8	-0.06	-0.10	-0.18	-0.40	0.08	-0.12	0.04	1.00	9	
9	0.12	-0.04	-0.06	-0.34	0.13	-0.12	0.21	-0.05	1.00	10
10	-0.10	0.17	0.07	0.05	0.00	-0.12	0.12	-0.10	0.12	1.00
11	-0.34	0.06	-0.10	0.64	0.14	-0.10	-0.12	-0.03	0.35	0.11
12	0.17	-0.05	-0.02	-0.12	0.10	-0.16	0.11	-0.23	0.31	0.02
13	0.06	-0.01	-0.16	-0.07	0.12	-0.06	0.03	-0.02	0.46	0.05
14	0.06	-0.14	0.11	0.34	0.13	-0.18	0.00	-0.17	0.27	0.04
15	-0.08	0.10	-0.01	0.08	-0.00	0.12	0.13	-0.10	0.07	0.01
16	-0.15	-0.19	-0.04	-0.04	0.57	-0.25	-0.07	0.16	0.25	0.05
17	0.08	0.13	0.08	0.07	0.01	0.01	0.09	-0.03	0.16	0.15
18	-0.07	0.36	0.02	0.03	0.08	0.15	0.02	0.11	-0.28	0.13
19	-0.07	-0.01	0.20	0.11	-0.06	-0.18	-0.02	-0.03	0.22	0.30

Key to the scales:

1	Job Stress	9	Cigarette Smoking	17	Vitamin-C-Dose
2	Job Nervousness	10	Pesticide Exposure	18	Education Level
3	Meals Interval	11	Chemical Exposure	19	Agricultural Occupation
4	Beef Interval	12	Oil Work		
5	Mix Drink Interval	13	Chemical Work		
6	Sex	14	Pork Interval		
7	Marital Status	15	Organ Meat		
8	Religion	16	Beer Interval		

Table 5 (continued)

Correlation Matrix

	I1	I2	I3	I4	I5	I6	I7	I8	I9
I1	1.00								
I2	0.14	1.00							
I3	0.55	0.22	1.00						
I4	0.22	0.07	0.20	1.00					
I5	0.00	0.03	0.19	0.10	1.00				
I6	0.31	0.04	0.05	0.15	-0.07	1.00			
I7	0.06	0.25	-0.00	0.11	0.04	-0.09	1.00		
I8	-0.03	-0.10	0.12	-0.24	-0.08	-0.02	0.01	1.00	
I9	0.18	-0.08	0.12	0.19	0.13	0.11	-0.01	-0.09	1.00

Key to the scales:

1	Job Stress	9	Cigarette Smoking	17	Vitamin-C-Dose
2	Job Nervousness	10	Pesticide Exposure	18	Education Level
3	Meals Interval	11	Chemical Exposure	19	Agricultural Occupation
4	Beef Interval	12	Oil Work		
5	Mix Drink Interval	13	Chemical Work		
6	Sex	14	Pork Interval		
7	Marital Status	15	Organ Meat		
8	Religion	16	Beer Interval		

correlation coefficients between all possible pairs of lifestyle behaviors.

Discussion

The statistical analysis completed in this study suggests that lifestyle behaviors which are represented in the NLUCSQ can be used to discriminate between subjects from a cancer population and those from a noncancer population. The overall contribution of each lifestyle behavior in predicting group membership was reported as probability of F-to-remove. Vitamin-C-dose yielded the largest significant F-to-remove value. The literature review contains two studies that support this finding (Colby-Morley, 1984; Phillips & Snowdon, 1985). Education Level yielded the next largest F-to-remove value. The relationship of Education Level and cancer is consistent with results of investigations of neoplasm development by Ernster et al. (1982), and by Devesa and Diamond (1983). The final lifestyle behavior entered into the prediction equation was Agricultural Occupation. The entry of this variable is consistent with findings of previous investigations by Beral et al. (1982), and by Stemhagen et al. (1983).

This investigation made use of a multivariate approach--discriminant analysis. Although statistical inference cannot be drawn from the univariate F

values in this study, univariate F tests were completed for descriptive purposes. The overall results of the univariate F tests support the formal finding in the discriminant analysis in that Vitamin-C-dose and Education Level were ranked as the first and second largest of the statistically significant univariate F values. However, Agricultural Occupation, a variable with a significant F-to-remove value, failed to yield a statistically significant univariate F. Unfortunately, no rationale for this inconsistency was found in the correlation matrix or in the other data. The next variable yielding a statistically-significant univariate F was Pork Interval. The rationale for the exclusion of this variable from the prediction equation is not obvious. The last variable yielding a statistically-significant univariate F was Job Nervousness, a variable which did not yield a significant F-to-remove value. The exclusion of Job Nervousness from the prediction equation can be explained by its correlation (r = .36) with Education Level, a variable in the prediction equation.

The total subject population of 312 members was reduced to 116 after the subjects were matched for age by including only subjects less than 56 years of age. This restricted selection achieved a much more equitable

distribution of ages between the cancer and the noncancer populations. In the final analysis, there were 80 noncancer subjects and 36 cancer subjects. The approximate mean ages for the noncancer and cancer populations were 36 years and 39 years, respectively.

It is believed that the omission of subjects in the computation of the discriminant analysis influenced the results. It could be that with an increase in number of subjects, the number of statistically significant variables entering the equation for the discriminant function would increase. The overall results of this study, in conjunction with the literature reviewed, suggest that lifestyle behaviors are associated with cancer. However, it is disappointing to note that only 3 of the original 19 lifestyle behaviors entered the prediction equation.

Summary

This investigation sought to test the hypothesis that lifestyle behaviors can be used to differentiate between a cancer and a noncancer population of subjects. Subjects were required to complete the Northeast Louisiana Cancer Study Questionnaire from which 19 lifestyle behaviors were selected for analysis.

Data were collected from 312 residents of Northeast Louisiana. Subjects who failed to answer one or more

items were excluded from the data analysis, leaving a total of 309 subjects--209 cancer subjects and 100 noncancer subjects. The mean-age difference between both groups was vastly different. The mean age for the cancer group was 63, and the mean age for the noncancer group was 40. Since there was reason to suspect a correlation between age and cancer incidence it became necessary to control for age. Restriction of subjects to persons younger than 56 years of age achieved a much more equitable distribution of ages between groups. The total sample was thus reduced to 116, of which there were 36 cancer subjects and 80 noncancer subjects. In the final statistical analysis, the approximate mean ages of the cancer and noncancer groups were 39 and 36, respectively.

Discriminant analysis with a stepwise entry of variables was used to treat the data and resulted in a statistically signficant discriminant function with three variables in the prediction equation. The overall contributions of each lifestyle behavior in predicting group membership were reported as F-to-remove. Vitamin-C-dose yielded the largest F-to-remove value. The next largest F-to-remove value was Education Level followed by Agricultural Occupation. The results of this investigation suggest that lifestyle behaviors can be used to successfully differentiate between a

cancer and a noncancer population of subjects. Predictive accuracy of differentiation in the present case was 79%.

APPENDIX

LIFESTYLE BEHAVIOR QUESTIONNAIRE

LIFESTYLE BEHAVIOR QUESTIONNAIRE*

SEX: 1 Male 2 Female

RACE: 1 White 2 Non-White

MARITAL STATUS:

1 Single 2 Married 2 Divorced

2 Widowed 2 Separated

EDUCATION:

1 2 3 4 5 6 7 8 9 10 11 12

College: 1 2 3 4 5 6 6+

RELIGION:

1 Catholic (Roman, Greek Orthodox, Russian Orthodox)

1 Jewish (Reformed, Orthodox, non-practicing)

1 Protestant (Baptist)

1 Mormon

1 Seventh Day Adventist

1 Non-Christian (Buddhist, Moslem)

2 None (Atheist, Agnostic)

*These variables are representative of the 19 items selected from the NLUCSQ which were used to test the hypothesis that cancer development is associated with lifestyle behaviors. It should be noted that this appendix is an approximation to the original questions in the NLUCSQ.

The numbers in the spaces, which were reserved for the subject responses, represent coded values used for statistical analysis. These values did not appear on the NLUCSQ.

JOB STRESS:

Does your job place you under stress?

__2__ Yes __1__ No

JOB NERVOUSNESS:

Does your job make you nervous?

__2__ Yes __1__ No

CIGARETTE SMOKING:

Do you smoke cigarettes? _____ Yes __1__ No

How many do you average smoking each day?

__2__ less than 1 pack __4__ between 1 and 2 packs

__3__ 1 pack __5__ more than 2 packs

AGRICULTURE OCCUPATION:

Is your occupation related to agriculture?

__2__ Yes __1__ No

OIL WORK:

Is your occupation related to the oil and gas industry?

__2__ Yes __1__ No

CHEMICAL WORK:

Is your occupation related to the chemical industry?

__2__ Yes __1__ No

PESTICIDE EXPOSURE:

Are you exposed to pesticides in your work?

__2__ Yes __1__ No

VITAMIN-C-DOSE:

	YES	NO
Do you take Vitamin C pills or capsules ---	( )	(1)
If yes, what daily dosage?		
less than 200 mg ----------	(2)	
200 mg or more but less than 500 mg ----	(3)	
500 mg or more but less than 1000 mg ---	(4)	
1000 mg or more ----------	(5)	

MEALS INTERVAL:

Do you usually eat balanced meals from the basic four food groups (milk/cheese group, meat group, bread/cereal group, and fruit/ vegetable group)? ----------	( )	(1)
If yes, how often?		
everyday ----------	(7)	
not everyday but more than once a week ----------	(6)	
once a week ----------	(5)	
less than once a week but more than once a month ----------	(4)	
once a month ----------	(3)	
less than once a month ----------	(2)	

BEEF INTERVAL:

If you eat beef, how often? ----------	( )	(1)
everyday ----------	(7)	
not everyday but more than once a week ----------	(6)	
once a week ----------	(5)	
less than once a week but more than once a month ----------	(4)	
once a month ----------	(3)	
less than once a month ----------	(2)	

PORK INTERVAL:

	YES	NO
Do you eat pork?	( )	(1)
If yes, how often?		
everyday	(7)	
not everyday but more than once a week	(6)	
once a week	(5)	
less than once a week but more than once a month	(4)	
once a month	(3)	
less than once a month	(2)	

ORGAN MEAT:

Do you eat organ meat (liver, kidney, etc.)	(2)	(1)

BEER INTERVAL:

Do you drink beer?	( )	(1)
If yes, how often?		
once a month or less	(2)	
once a week	(3)	
once a day	(4)	
more than once a day	(3)	

MIX DRINK INTERVAL:

Do you drink alcoholic mixed beverages?	( )	(1)
If yes, how much?		
once a month or less	(2)	
once a week	(3)	
once a day	(4)	
more than once a day	(5)	

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